

CLAIMS

What is claimed is:

- 5 1. A method for producing a steel rail having a high content of carbon, comprising:
 finish rolling said rail in two consecutive passes, with a reduction rate per pass of a cross-section of said rail of 2-30%,
 wherein conditions of said finish rolling satisfy the
10 following relationship:
 $S \leq CPT1$
 wherein CPT1 is the value expressed by the following expression 1
 $CPT1 = 800 / (C \times T)$ (expression 1)
15 wherein
 S is the maximum rolling interval time (seconds), and
 (C × T) is defines as follows;
 C is the carbon content of the steel, wherein the carbon content is more than 0.85 mass%, but less than or equal
20 to 1.40 mass%, based on the total mass of the steel, and
 T is the maximum surface temperature (°C) of a rail head.
2. A method for producing a steel rail having a high content of carbon, comprising:
25 finish rolling said rail in three or more passes, with a reduction rate per pass of a cross-section of said rail of 2-30%,
 wherein conditions of said finish rolling satisfy the following relationship:
 $S \leq CPT2$
30 wherein CPT2 is the value expressed by the following expression 2,
 $CPT2 = 2400 / (C \times T \times P)$ (expression 2)
 wherein
 S is the maximum rolling interval time (seconds), and

(C × T × P) is defines as follows;

C is the carbon content of the steel rail, wherein the carbon content is more than 0.85 mass%, but less than or equal to 1.40 mass%, based on the total mass of the steel, and,

T is the maximum surface temperature (°C) of a rail head, and P is the number of passes, which is 3 or more.

3. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises at least one selected from the group consisting of (a) Si in an amount of 0.05-2.00 mass%, and (b) Mn in an amount of 0.05-2.00 mass%; said rail having a balance of Fe, optionally including impurities.

4. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises at least one selected from the group consisting of (a) Cr in an amount of 0.05-2.00 mass%, and (b) Mo in an amount of 0.01-0.50 mass%; said rail having a balance of Fe, optionally including impurities.

5. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises B in an amount of 0.0001-0.0050 mass%, and a balance of Fe, optionally including impurities.

6. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises at least one selected from the group consisting of (a) Co in an amount of 0.003-2.00 mass%, and (b) Cu in an amount of 0.01-1.00 mass%; said rail having a balance of Fe, optionally including impurities.

7. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises Ni in an

amount of 0.01-1.00 mass%, and a balance of Fe, optionally including impurities.

8. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises at least one selected from the group consisting of (a) Ti in an amount of 0.0050-0.0500 mass%, (b) Mg in an amount of 0.0005-0.0200 mass%, and (c) Ca in an amount of 0.0005-0.0150 mass%; said rail having a balance of Fe, optionally including impurities.

9. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises Al in an amount of 0.0100-1.00 mass%, and a balance of Fe, optionally including impurities.

10. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises Zr in an amount of 0.0001-0.2000 mass%, and a balance of Fe, optionally including impurities.

11. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises N in an amount of 0.0060-0.0200 mass%, and a balance of Fe, optionally including impurities.

12. The method according to claim 1 or claim 2, wherein in addition to said carbon, said rail further comprises at least one selected from the group consisting of (a) V in an amount of 0.005-0.500 mass%, and (b) Nb in an amount of 0.002-0.050 mass%; said rail having a balance of Fe, optionally including impurities.

13. The method according to claim 1 or claim 2, wherein chemical composition(s) included in said rail meet the following relationship:

$$0.30 \geq V(\text{mass}\%) + 10 \times \text{Nb}(\text{mass}\%) + 5 \times \text{N}(\text{mass}\%) \geq 0.04$$

14. The method according to claim 1 or claim 2, further comprising:

5 immediately after said finish rolling, cooling the surface of said rail head at a cooling rate of 2-30°C/sec. until the surface temperature reaches 950-750°C.

15. The method according to claim 14, further comprising:

10 after said cooling step, when the temperature of the rail head is more than 700°C, cooling the surface of the rail head at a cooling rate of 2-30°C/sec. until the surface temperature reaches at least 600°C; and then

allowing the rail to further cool at room temperature.

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16. The method according to claim 1 or claim 2, further comprising:

after said finish rolling process, when the temperature of the rail head is more than 700°C, cooling the surface of the rail head at a cooling rate of 2-30°C/sec. until the surface temperature reaches at least 600°C, and then

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allowing the rail to further cool at room temperature.